

# MT 70

VIDEO DISPLAY TERMINAL

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## USER'S MANUAL

# MORROW



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However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the equipment with respect to the receiver
- Move the equipment away from the receiver
- Plug the equipment into a different outlet so that the equipment and receiver are on different branch circuits

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio TV Interference Problems"

This booklet is available from the U.S. Government Printing Office, Washington, DC 20402. Stock No. 004-000-00345-4.

## UNDERWRITERS LABORATORY NOTICE

Before connecting your terminal, read the following precautions carefully. Your terminal is designed to be switched for operation on different voltages as follows:

115V 60 Hz  
230V 50 Hz

This terminal is equipped with a three-wire grounding type plug having a third (grounding) pin. This plug will fit only into a grounded outlet. This is a safety feature. If you are unable to insert the plug into the outlet, contact your electrician to replace your obsolete outlet. DO NOT DEFEAT THE SAFETY PURPOSE OF THE GROUNDING PLUG.

**DO NOT PLUG THE POWER PLUG INTO THE OUTLET WITHOUT FIRST CHECKING THAT THE VOLTAGE SWITCH IS IN THE PROPER POSITION FOR THE LOCAL POWER SUPPLY, AND THAT THE PROPER POWER SUPPLY CORD IS BEING USED. SEE FIG. 2-1.**

Your terminal will not operate if the switch is in the "220 Volt" position and you plug it into a "110 Volt" supply. Conversely, plugging it into a "220 Volt" supply when the voltage selector switch is in the "110 Volt" position may cause serious damage to the terminal.

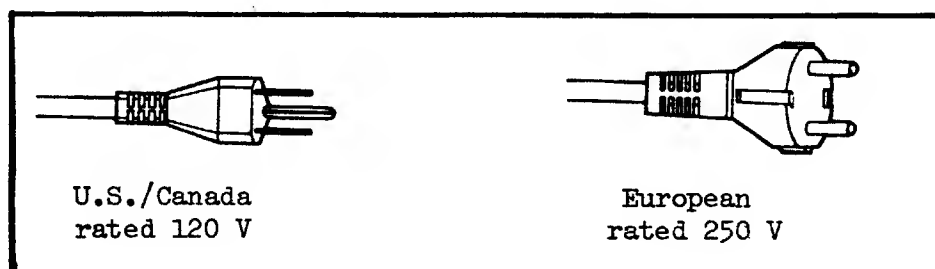
**Note that using an incorrect power source damaging to the terminal will void the manufacturer's warranty.**

Voltage Selection - Determine the voltage available in your location, then make certain the Voltage Selector Switch on the back of your terminal is set accordingly. If in doubt, contact your local power company.

The Voltage Selector Switch is located on the back of the terminal, and is recessed to prevent accidental switching.

Power Cord Plug - The power supply cord that comes with your terminal is provided with a three-prong grounding type plug (NEMA type 5-15) which is suitable for use with a 110 Volt AC source as found in the United States and Canada.

In European countries where the local power supply is 220 Volts AC, a suitable adapter must be purchased which will allow you to convert the flat-blade plug to the European style round pin plug.



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# MT 70 USER'S GUIDE

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## SECTION 1: GENERAL DESCRIPTION

This section describes the features of the MT 70 along with its capabilities. Appendix C lists the MT 70's complete specifications.

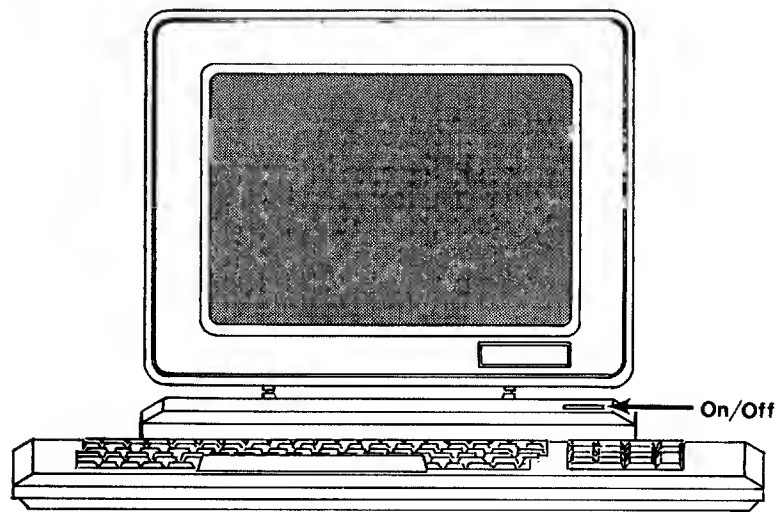
### **MT 70 FEATURES**

- o Twelve inch (30.5 cm) diagonal non-glare display in swivel-and-tilt enclosure
- o Full 128 ASCII character set, in an 80 column by 24-row format, plus 64 special graphics characters and 45 special characters for foreign character sets
- o Three visual attributes - half intensity, reverse and underline
- o Detachable 93-key keyboard with a typewriter style layout
- o Eighteen key numeric keypad for numeric entry or special applications functions
- o 30 function keys, including numeric keypad
- o RS-232C serial asynchronous interface
- o Four selectable transmission rates - 300, 1200, 9600, 19200 baud

### **PHYSICAL DESCRIPTION**

The MT 70 is a two-piece modular design that includes a monitor assembly and a keyboard assembly. The monitor assembly contains the main logic board, the display driver board, the cathode ray tube (CRT), and the regulated power supply.

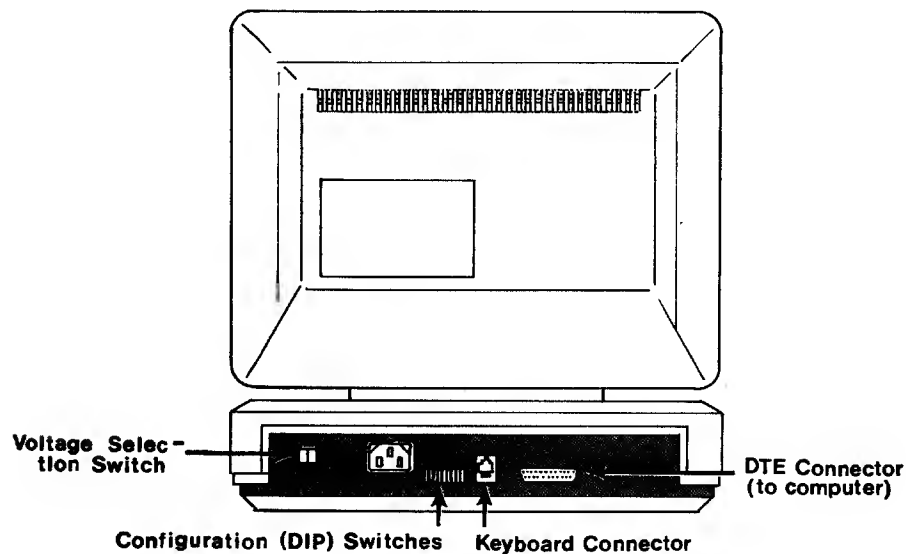
The CRT is mounted in a swivel enclosure atop a pedestal. Its tilt and viewing angle are both adjustable. The detachable keyboard has retractable feet that either slant the keyboard or allow it to lay flat, according to different typists' preferences. The keys have sculptured surfaces to prevent finger slip-off.



**Figure 1-1: MT 70 Front View**

At the back of the monitor housing, you will find the connector to the computer (marked DTE), the keyboard connector, configuration switches, and the power cord socket.

The keyboard assembly contains the 93-key keyboard and associated logic. A six-foot coiled cord connects the keyboard to the monitor assembly. Both assemblies are packaged in lightweight, compact housings that provide flexibility and convenience in operation.



**Figure 1-2: MT 70 Rear View**

The On/Off Switch is located on the right-front corner of the monitor pedestal. The Contrast Control is on the right side of the monitor. (Note: The "Contrast" control operates as both a contrast and brightness control. There is no user-accessible Brightness Control as such.)

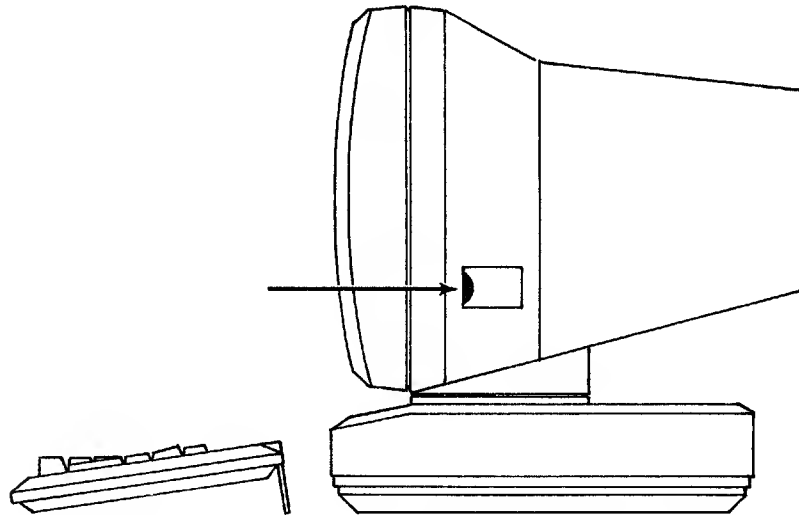


Figure 1-3: Location of the Contrast Control

#### CHARACTER SET

The standard MT 70 character set contains 128 ASCII characters, 32 of which are control characters (see Figure 1-4 and Table 1-1). It also has 45 special characters for European character sets, and 64 special graphics characters (allocated; the number actually implemented varies). At least 16 of these are line drawing graphics characters, plus another 30 or more block graphic characters.

#### MT 70 WORD STRUCTURE

The MT 70 transmits serial asynchronous data in 11 bit format in the following sequence: one start bit, seven data bits, one parity bit and two stop bits. The parity bit can be either odd, even, mark or space, and is defined by paddles 3 and 4 of the rear panel DIP switch.

The received data is formatted the same as the transmitted data. The word structure, baud rates, and other communications characteristics are set up with the DIP switch on the rear panel. Refer to Section 2 for details.

#### 230 VAC OPERATION

The MT 70 will operate on either 110 or 220 volts ac, depending upon the rating of the power source and selection of the line voltage switch on the rear panel (see "Line Voltage Selection" in Section 2).

|    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|
| 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 0A | 0B | 0C | 0D | 0E | 0F |   |
| N0 | S4 | X5 | E5 | E4 | E5 | R4 | R1 | R5 | M4 | Y4 | YF | F4 | G4 | S5 | S1 |   |
| 10 | D1 | D2 | D3 | D4 | N4 | S5 | E5 | C4 | E4 | S5 | E5 | F5 | G5 | R5 | U5 |   |
| 20 | !  | "  | #  | \$ | %  | &  | '  | (  | )  | *  | +  | ,  | -  | .  | /  |   |
| 30 | 0  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | :  | ;  | <  | =  | >  | ? |
| 40 | @  | A  | B  | C  | D  | E  | F  | G  | H  | I  | J  | K  | L  | M  | N  | O |
| 50 | P  | Q  | R  | S  | T  | U  | V  | W  | X  | Y  | Z  | [  | \  | ]  | ^  | _ |
| 60 | `  | a  | b  | c  | d  | e  | f  | g  | h  | i  | j  | k  | l  | m  | n  | o |
| 70 | p  | q  | r  | s  | t  | u  | v  | w  | x  | y  | z  | {  |    | }  | ~  | % |
| 80 | ó  | é  | ø  | À  | æ  | æ  | à  | à  | °  | ç  | é  | ù  | è  |    |    | u |
| 90 | Ä  | ö  | Ü  |    | ä  | ö  | u  | ß  | ½  | ò  | ì  | À  | ì  | Ñ  | ¿  | É |
| A0 | ñ  | á  | ó  | ó  | í  |    | í  | é  | é  | á  | í  | ó  | ó  | ™  | ©  | ® |
| B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | BA | BB | BC | BD | BE | BF |   |
| C0 | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | CA | CB | CC | CD | CE | CF |   |
| L  | r  | ı  | ı  | L  | ı  | ı  | ı  | ı  | ı  | ı  | ı  | ı  | ı  | ı  | ı  |   |
| D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 | D8 | D9 | DA | DB | DC | DD | DE | DF |   |
| E0 | E1 | E2 | E3 | E4 | E5 | E6 | E7 | E8 | E9 | EA | EB | EC | ED | EE | EF |   |
|    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| F0 | F1 | F2 | F3 | F4 | F5 | F6 | F7 | F8 | F9 | FA | FB | FC | FD | FE | FF |   |
|    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |

Figure 1-4: 220 Character ASCII Format, with Hex Codes

Additional graphics characters may be available by the time you read this. Appendix B lists BASIC and PILOT programs that will display all of the graphics characters programmed into your terminal.

**Table 1-1: Displayable USASCII Character Set and Control Codes**

| HEX<br>BYTE |              |             | CONTROL CHARACTERS |               | DISPLAYABLE CHARACTERS |     |     |     |     |     |
|-------------|--------------|-------------|--------------------|---------------|------------------------|-----|-----|-----|-----|-----|
|             | 1ST          |             | 0                  | 1             | 2                      | 3   | 4   | 5   | 6   | 7   |
|             | BITS<br>4321 | BITS<br>765 | 000                | 001           | 010                    | 011 | 100 | 101 | 110 | 111 |
| 0           | 0000         |             | NUL                | DLE           |                        | 0   | @   | P   | l   | p   |
| 1           | 0001         |             | SOH                | DC1           | !                      | 1   | A   | a   | a   | p   |
| 2           | 0010         |             | STX                | DC2           | "                      | 2   | B   | a   | a   | {   |
| 3           | 0011         |             | ETX                | DC3           | #                      | 3   | E   | S   | f   | s   |
| 4           | 0100         |             | EOT                | DC4           | \$                     | 4   | D   | T   | a   | {   |
| 5           | 0101         |             | ENQ                | NAK           | %                      | 5   | E   | U   | a   | p   |
| 6           | 0110         |             | ACK                | SYN           | \$                     | 6   | I   | V   | f   | {   |
| 7           | 0111         |             | BEEP               | ETB           | '                      | 7   | G   | W   | a   | {   |
| 8           | 1000         |             | BS (←)             | CAN           | (                      | 8   | H   | f   | f   | }   |
| 9           | 1001         |             | (SKIP) HT          | EM            | *                      | 2   | I   | Y   | j   | {   |
| A           | 1010         |             | LF (↓)             | SUB           | *                      | :   | I   | Z   | j   | z   |
| B           | 1011         |             | VT (↑)             | ESC           | +                      | :   | K   | I   | I   | {   |
| C           | 1100         |             | FF (→)             | FS            | ,                      | <   | I   | \   | I   | I   |
| D           | 1101         |             | CR                 | GS            | (                      | =   | M   | f   | m   | }   |
| E           | 1110         |             | SO                 | (HOME) RS     | *                      | >   | N   | ^   | n   | ~   |
| F           | 1111         |             | SI                 | (NEW LINE) US | /                      | ?   | O   | —   | o   | DEL |

USE CTRL KEY  
WITH DISPLAYABLE  
CHARACTER KEYS  
TO PRODUCE  
CONTROL CODES

**Displayable USASCII Character Set and Control Codes**

## NOTES

## **SECTION 2: INSTALLATION**

This section contains the simple unpacking and installation instructions for the **MT 70**. Once you unpack and inspect your new terminal, you will set the DIP switch on the rear panel to determine terminal configuration (baud rate, parity, character set and function key sequence type). You will then connect the cable provided to the **MT 70** and your computer, turn your terminal on, and adjust the intensity of characters displayed on the screen.

### **UNPACKING AND INITIAL INSPECTION**

Each **MT 70** is thoroughly inspected and carefully packaged with the monitor and keyboard in separate cartons prior to shipment. Every precaution is taken to ensure that each unit is complete and ready for installation at the customer's site. However, it is recommended that each unit be inspected upon receipt for transit damage. Start by examining the exterior of the package for evidence of rough or careless handling. If shipping damage exists, note the condition on the waybill, notify the carrier, and contact your dealer.

### **MATERIALS CHECKLIST**

Before attempting to hook anything up, be sure the monitor and keyboard cartons contain all of these pieces:

"Video Display Terminal" carton -

- o Monitor assembly
- o 5 foot power cord (usually black)
- o 4 foot RS-232 cable (usually white)

"MT 70 Keyboard" carton -

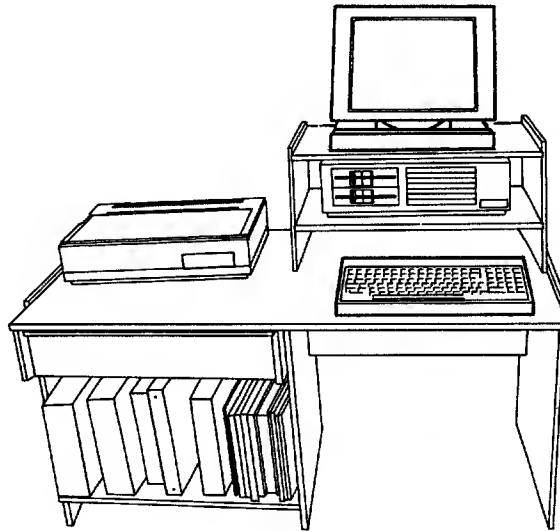
- o Keyboard
- o 6 foot coiled keyboard cable

If any of these pieces are missing, contact your dealer.

**SELECTING A WORK STATION**

The **MT 70** may be conveniently used in a normal office environment, as no special mounting provisions are required.

Refer to Table C-1 (Appendix C) for the **MT 70's** electrical and physical requirements. In general, it should be within 5 feet (1.5 m) of a power receptacle and within 4 feet (1.2 m) of the computer. The keyboard should be low enough to avoid shoulder strain. The monitor should be placed anywhere that eyestrain isn't a problem, including atop the computer.



**Figure 2-1: Typical Work Station**

**CAUTION:**

Whenever you move the **MT 70** from a cold to a warmer environment, be sure to allow sufficient time for the equipment to reach room temperature before turning it on. Condensation from the temperature differential could possibly damage the unit.

A standard three-pronged 115-volt (230-volt) ac power outlet should be within reach of the **MT 70's** power cord (5 feet or 1.5 meters). Voltage selection is discussed in the following section.



**SET-UP PROCEDURE**Line Voltage Selection

Once you have selected your work area, verify that the voltage switch on the rear panel is properly set for the site's power source.

The MT 70 line voltage can be set for either 115-volt or 230-volt AC operation. Units shipped to customers in the United States are set for 115-volt operation, but may be switched to 230-volt operation by changing the line voltage switch at the rear of the MT 70 (see Figure 2-2).

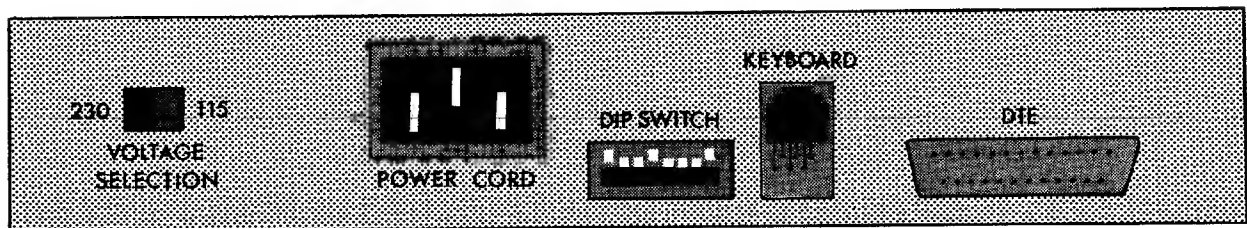


Figure 2-2: MT 70 Rear Panel

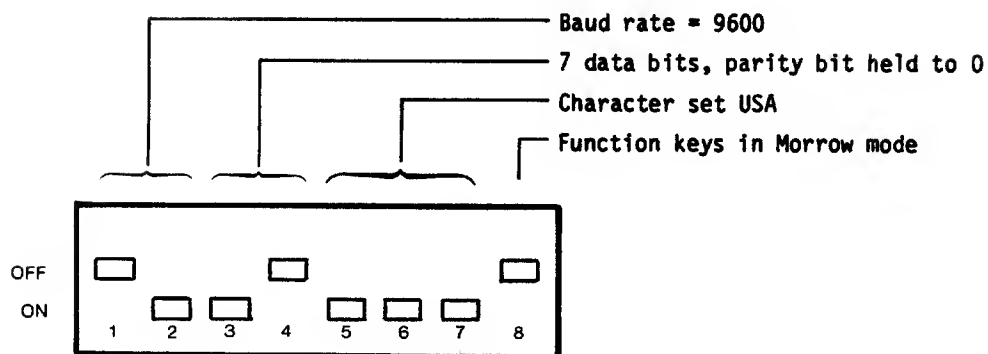
Setting the Configuration (DIP) Switch

The 8-position DIP switch located on the rear panel is used to set the characteristics of how the terminal communicates with its computer. Refer to Figure 2-2 for the location of the switch (SW1) and then set the paddles on the switch to match your computer's requirements.

Switches 1 and 2 affect baud rate, 3 and 4 set parity, 5, 6 and 7 select the character set and Switch 8 is used to select the key sequence sent to the computer when a function key is pressed. Table 2-1 lists all of these details.

Use a jeweler's screwdriver or pencil point to reset a paddle, if necessary.

Figure 2-3 shows this switch as set at the factory for use with Morrow computers; Table 2-1 lists the available switch settings.



**Figure 2-3: Default Switch Settings (Correct for all Morrow Computers)**

Table 2-1: Available Configuration Switch Settings

| BAUD RATE   |          | PADDLE 1 | PADDLE 2 |
|---|----------|----------|----------|
| 19200   |          | ON       | ON       |
| 9600*   |          | OFF      | ON       |
| 1200  |          | ON       | OFF      |
| 300   |          | OFF      | OFF      |
| PARITY  |          | PADDLE 3 |          |
| ENABLED   |          | OFF      |          |
| DISABLED*   |          | ON       |          |
| PARITY SELECT   | PADDLE 3 |          | PADDLE 4 |
| ODD   | OFF      |          | ON       |
| EVEN  | OFF      |          | OFF      |
| MARK  | ON       |          | ON       |
| SPACE*  | ON       |          | FF       |
| CHARACTER SET   | PADDLE 5 | PADDLE 6 | PADDLE 7 |
| U.S.*   | ON       | ON       | ON       |
| U.K.  | OFF      | ON       | ON       |
| FRENCH  | ON       | OFF      | ON       |
| GERMAN  | OFF      | OFF      | ON       |
| SPANISH   | ON       | ON       | OFF      |
| DANISH/NORWEGIAN  | OFF      | ON       | OFF      |
| SWEDISH/FINNISH   | ON       | OFF      | OFF      |
| ITALIAN   | OFF      | OFF      | OFF      |
| FUNCTION KEY<br>SEQUENCE TYPE   |          | PADDLE 8 |          |
| MORROW MODE*<br>(starts with ASCII FS (1CH),<br>followed by a character, no<br>terminator)    |          | OFF      |          |
| TELEVIDEO MODE<br>(starts with ASCII SOH (01H),<br>followed by a character, CR<br>terminator) |          | ON       |          |

\* Indicates factory setting for use with Morrow computers

## CONNECTING THE MT 70

The MT 70 may be cabled directly to a local computer, or it may be connected to a modem for communication over telephone lines to a remote computer.

### The DTE Connector (RS-232C Interface)

The DTE (Data Terminal Equipment) connector on the MT 70's rear provides RS-232C signals at levels specified in the RS-232 standard. One end of an RS-232C cable should be connected to this port (this is the short white cable that came with the MT 70). The other end should be connected to the required serial port on your computer or modem (marked TERMINAL on Morrow Micro Decisions).

The maximum reliable cable length is 50 feet for RS-232C applications. Morrow provides a four-foot (1.2 m) cable with each MT 70.

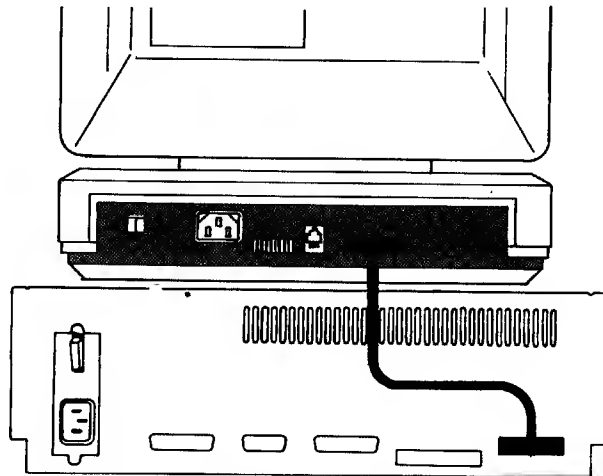


Figure 2-4: Typical Computer Hookup (Morrow MD-11 shown)

### Power Receptacle

First make sure that the MT 70's power switch is turned OFF. Then connect its power cord to the socket on the rear of the MT 70 and to a three-prong (grounded) power receptacle.

### Keyboard Cable

The coiled cable that was packed with the keyboard should be connected with the short straight end at the keyboard side, and the long straight end at the monitor side.

The monitor's keyboard connector is shown in Figure 2-2. A similar connector is on the keyboard's rear edge.

That concludes hooking up the MT 70. In the next section, you'll verify that everything is set up right and learn the basics of operating the terminal.

### SECTION 3: OPERATION

#### **TURNING POWER ON**

1. The **MT 70** power switch is located on the right front of the monitor pedestal (refer to Figure 1-1). Make sure the unit is plugged in, line voltage is properly set, and turn the switch to the ON position.
2. Wait approximately 10 seconds for the unit to warm up. The cursor should appear in the HOME position (upper left corner) and the terminal will sound its "bell", actually more of a beep.

If the cursor does not appear, turn off the **MT 70**, wait 15 seconds and apply power again. If the cursor still does not appear, check that the CONTRAST control is turned up (see Contrast Control below), and if that doesn't help, contact your dealer.

3. Be aware that things you type at this point will NOT show up on the screen. The **MT 70** has to be attached to a computer that is properly booted before everything appears to work right. See your computer manual for its booting instructions.

#### Contrast Control

The contrast of characters and screen background may be adjusted by turning the CONTRAST control knob on the right side of the monitor (see Figure 1-3). If you turn on power to the **MT 70**, and the cursor does not appear, turn this knob counterclockwise until the contrast of cursor to screen background is sharp enough to comfortably view the display.

(We realize that counterclockwise is unusual for turning something up, but your hand actually moves up when you turn the control in this direction.)

#### Screen Saver

The **MT 70** offers a "Screen Saver" function, which is enabled when the terminal is shipped from the factory, but you can disable it if you like.

If no keys are pressed for 15 minutes, or data has not been received from the computer in this period of time, the screen will automatically go blank. This prolongs the life of the phosphor on the screen.

Once data is received by the computer, or any key is pressed on the keyboard, the screen will appear normally. Data previously displayed, before the screen went blank, is not lost as long as the terminal is not powered off. The keystroke you use to restore the display is not sent to the computer.

To disable the Screen Saver, type:

**ESC @ 1**

Once disabled, enter the following command to re-enable this feature:

**ESC @ 0**

#### **TURNING POWER OFF**

Turn off the **MT 70** by setting the ON/OFF switch to OFF. With the Morrow MD-11 computer, you should PARK the computer's hard disk first, before turning off either the terminal or computer.

#### **OPERATING MODES**

This is a technical discussion so skip it if you're just trying to get started.

##### Character and Function Key Sequences

The **MT 70** operates in the On-Line Conversation Mode. Data entered from the keyboard is immediately transmitted to the computer, character-by-character. All ASCII characters are sent directly. This includes the normal ASCII characters ("space" to DEL, i.e. 20 to 7F Hex) and control characters. For all other characters, meaning in general those transmitted by the function keys, a two or three character sequence is transmitted to the computer. The character sequence sent starts either with

1. (Televideo mode) the ASCII character SOH (01 Hex or ^A), followed by a function code, and terminated by a carriage return (0D Hex, ^M), or
2. (Morrow mode) 1C Hex, followed by a function code, with no carriage return.

Configuration switch paddle 8 sets which sequence is sent by the function keys. The function codes sent are listed in Table 3-2; keys send out different codes depending on whether or not the SHIFT or CTRL key is pressed. Displayed data is echoed from the computer.

##### Normal Mode

Normal Mode causes the 96-displayable ASCII characters (20-7F Hex) to be displayed when received. The 32 control codes (00-1F Hex) are acted upon only if they are control codes recognized by **MT 70**; otherwise they are ignored.

The **MT 70**'s control codes are listed in Table 3-3.

### Monitor Mode

Setting Monitor Mode causes the terminal to display all 32 control codes (00-1F Hex) instead of acting upon them. This is particularly useful as a software debugging tool.

Monitor mode is activated by **ESC U**; it is returned to normal mode with **ESC X**.

### Full vs. Half Duplex

The **MT 70** operates in the full duplex mode exclusively. This means that for a character to be displayed onscreen it must have been sent to and echoed back from a computer. Local mode can be simulated by jumpering pins 2 and 3 on the **MT 70**'s DTE connector. A bent paper clip is usually sufficient for this purpose.

### Graphics Mode

Figure 1-4 shows the screen's dot patterns for normal ASCII characters (20-7E Hex), non-English characters (80-AC Hex), plus special line and block graphics characters (AD-FF Hex).

The non-English and graphics characters are grouped into what is called the "alternate character set." Codes for members of this set are generated by adding 80 Hex to a corresponding member of the normal ASCII character set.

To display a member of the alternate character set, the terminal must be put into Graphics Mode. When you set the DIP switches for a Non-English character set, the going in and out of Graphics Mode is handled automatically by the **MT 70**'s firmware.

- o To display a single member of the alternate set, enter:

**ESC ! N**

where "N" is the corresponding normal ASCII character. For example, to display the copyright symbol, press the ESC key, then the exclamation point (SHIFT + 1), and finally the ASCII character corresponding to this symbol, which happens to be the period. Using Figure 1-4, alternate characters are always exactly eight lines below their ASCII counterparts, and in the same column.

- o To put the **MT 70** into graphics mode for more than one character, type:

**ESC \$**

Now every key you type will display a non-English or graphics character, unless there is currently no member in the alternate character set corresponding to a certain key. In that case, either no character - or the normal character - will appear.

You can draw pictures using NewWord or some other text editor by putting the **MT 70** into Graphics Mode before running the editor program. Of course, its menus and messages will appear in strange characters, but it's assumed that you're familiar enough with the program to tolerate this.

- o To put the **MT 70** back into normal mode, enter:

**ESC %**

#### Special Note on PILOT

Morrow's PILOT programming language has an undocumented feature that lets you put the **MT 70** into Graphics Mode from within a PILOT program. Use this command:

**T:^^1B^^24**

This tells PILOT to send the Hex codes for ESC \$. To get back into normal mode through PILOT, use the command:

**T:^^1B^^25**

which is Hex for ESC %. See Appendix B for equivalent BASIC commands, and additional PILOT tricks.

#### **KEYBOARD OPERATION**

You'll be using a keyboard very similar to that of a standard office typewriter to enter data and perform control operations. Functionally the keyboard consists of the displayable character keys (letters, numbers, punctuation marks) and various control, function and modifier keys. All keys will repeat automatically if held down for approximately one-half second or more. The keyboard is made up of the following classes of keys:

- o Alphanumeric and Punctuation Keys
- o Numeric Keypad
- o Modifier Keys
- o Cursor Control Keys
- o Function Keys
- o Special Operation Keys



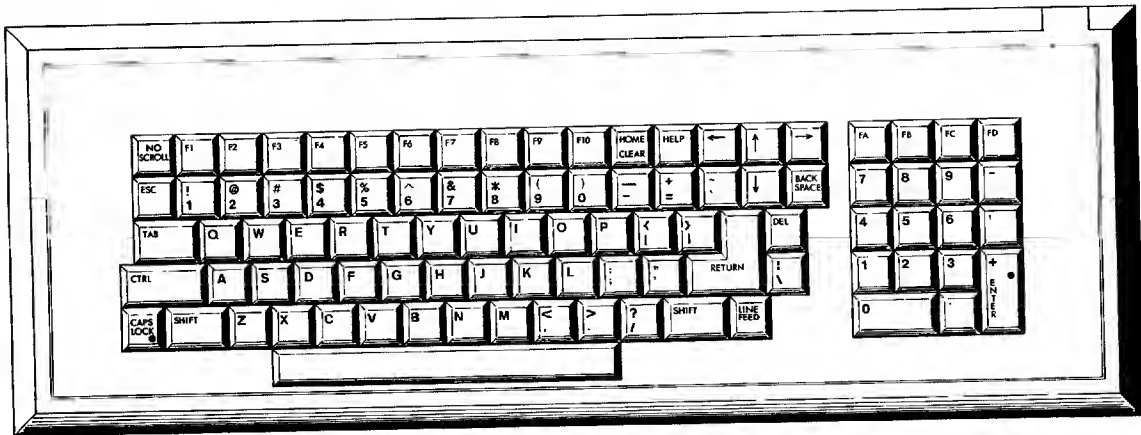


Figure 3-1: MT 70 Keyboard

### Alphanumeric and Punctuation Keys

The letters (both upper and lower case), numbers, space, and punctuation marks that make up the normal ASCII display set are all included. In Hex, this is 20 (space), 21-7E, and 7F (DEL).

The SHIFT key operates as with a normal typewriter. It also activates a second code for the function keys. The CTRL (Control) key has a similar effect, turning a keystroke into a "control code", which may or may not have any meaning to your computer, depending on the program that's running.



Figure 3-2: Alphanumeric and Punctuation Keys

The CAPS LOCK key translates letters ONLY to their upper cases, as SHIFT would do. It has no effect, however, on numeric, punctuation, or function keys. A small lamp (LED) glows on the key when CAPS LOCK is activated. Press the key a second time to de-activate it.

### Numeric Keypad

The numeric keypad simulates a standard calculator keyboard. The codes sent out when you use these numbers are exactly the same as the codes for the numbers across the top row of the alphanumeric keys. This is also true of the comma, period, and minus sign.

The ENTER key operates exactly as the RETURN key on the alphanumeric keyboard.

The numeric keypad can also function as a set of 14 extra function keys that you can define with Morrow's KEY.COM, Smart Key, or some other function key software. A likely use of this capability is when running a calculator program. Then the numbers would be programmed as numbers (untranslated), the minus, period, and comma also programmed as themselves, and the ENTER key programmed as a plus sign. (NOTE: This is the ONLY reason a plus sign appears on the ENTER key - in case you want to set it up as a calculator keypad.) You could further define FA to be "x" for multiply, etc., whatever the calculator program recognizes.

The keystrokes that put the numeric keypad into its function key mode are:

ESC [

The LED in the ENTER key glows during this mode. To return the numeric keypad to normal operation, type:

ESC ]

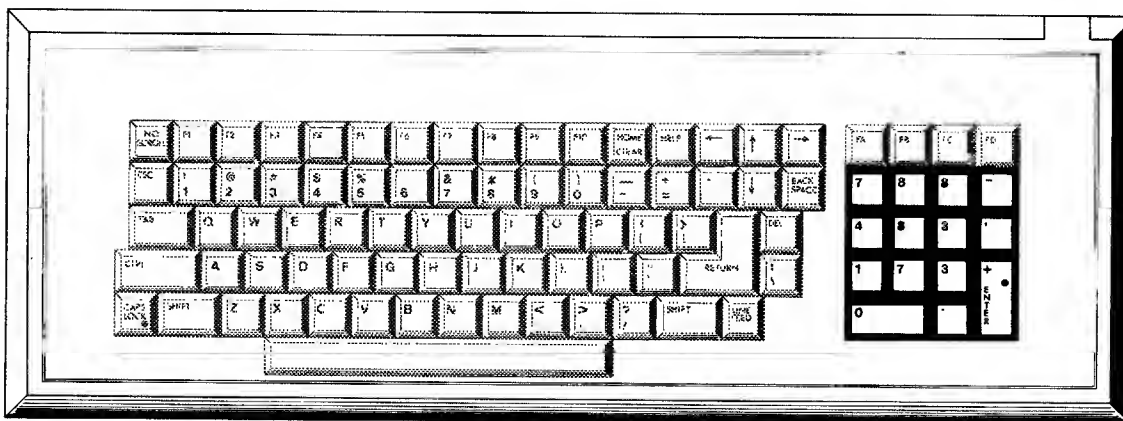


Figure 3-3: Numeric Keypad

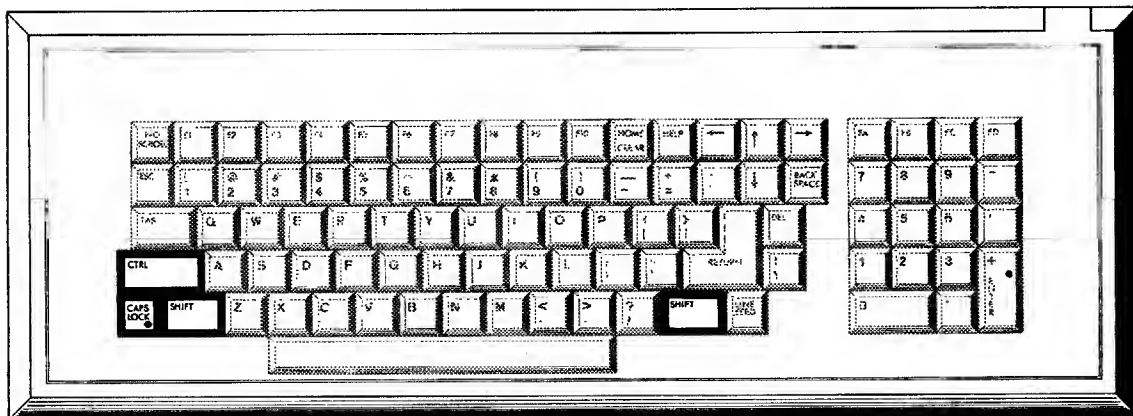
Table 3-1 lists the codes sent from the numeric keypad when the terminal is in Numeric Keypad Function Mode.

**Table 3-1: Numeric Keypad (Function Mode)**

| KEY     | UNSHIFTED CODE |       | SHIFTED CODE |         | CONTROL CODE |       |
|---------|----------------|-------|--------------|---------|--------------|-------|
|         | Hex            | ASCII | Hex          | ASCII   | Hex          | ASCII |
| 0       | 30             | 0     | 20           | "space" | 10           | DLE   |
| 1       | 31             | 1     | 21           | !       | 11           | DC1   |
| 2       | 32             | 2     | 22           | "       | 12           | DC2   |
| 3       | 33             | 3     | 23           | #       | 13           | DC3   |
| 4       | 34             | 4     | 24           | \$      | 14           | DC4   |
| 5       | 35             | 5     | 25           | %       | 15           | NAK   |
| 6       | 36             | 6     | 26           | &       | 16           | SYN   |
| 7       | 37             | 7     | 27           | '       | 17           | ETB   |
| 8       | 38             | 8     | 28           | (       | 18           | CAN   |
| 9       | 39             | 9     | 29           | )       | 19           | EM    |
| Decimal | 2A             | *     | 2B           | +       | 2C           | ,     |
| Enter   | 2D             | -     | 2E           | .       | 2F           | /     |
| Dash    | 3A             | :     | 3B           | ;       | 3C           | <     |
| Comma   | 3D             | =     | 3E           | >       | 3F           | ?     |

### Modifier Keys

The following keys do not generate any output by themselves, but modify the code generated by the alphanumeric keys on the keyboard.



**Figure 3-4: Modifier Keys**

SHIFT causes the upper legend character of a double legend key to be produced when pressed in conjunction with either SHIFT key. The 26-alpha characters are shifted for upper-case, and unshifted for lower-case. It turns the numbers on the alphanumeric keyboard into their respective special symbols (e.g. 7 into &).

SHIFT also produces a shifted code for all of the function keys, effectively doubling the number of function keys. In other words, SHIFT and F1 together send out a different code from F1 alone. (The same is true of the CTRL key.)

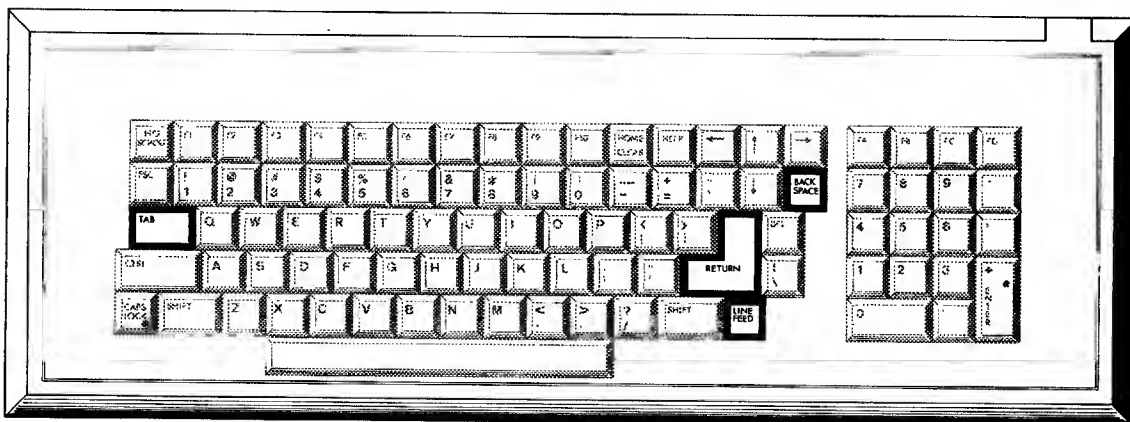
CAPS LOCK is a push-on/push-off key that causes the 26 letter keys to stay shifted (upper-case) when on. The numeric and punctuation keys, as well as the various control keys, are not affected. The LED inside the CAPS LOCK key glows when the lock is on.

CTRL causes one of the 32-ASCII control codes to be generated when pressed in conjunction with an otherwise displayable character key. The character generated will not occupy a space on the display, unless a program like NewWord responds to the control code by echoing back something like "^B". The control codes utilized by the MT 70 are detailed in Table 3-3.

CTRL also changes the code sent by function keys. Therefore each function key can have three meanings: alone, shifted, or with CTRL.

## Cursor Control Keys

The Cursor is the (usually) blinking block that's used to indicate the next character position to be entered on the display. The Cursor Control Keys are NOT the same as the cursor keys (the ones with arrows on them), which are considered function keys. The following keys are used to position the cursor on the display:



**Figure 3-5: Cursor Control Keys**

TAB will cause the cursor to advance to the next tab stop and an HT (09 Hex or ^I) code to be generated. Tab stops are automatically set at every eight character positions, 0, 8, 16,...72. If you're running a word processing program, TAB works in the same fashion but you have more control over where the tab stops are positioned. TAB, when pressed with SHIFT or CTRL, also serves as a function key.

BACKSPACE causes the cursor to move one character position to the left, or to the end of the previous line if the cursor was at the beginning of a line. A BS code (08 Hex or ^H) is generated when the key is pressed.

RETURN moves the cursor to the beginning of the line it was in, or the beginning of the next line down (carriage return plus line feed) depending upon the program being run. The code sent by the RETURN key consists of 0D Hex (carriage return or ^M) and 0A Hex (line feed or ^J).

LINE FEED moves the cursor to the same column position of the next line down. This will cause a scroll operation to occur if the cursor was on the bottom line of the display. The Line Feed key produces an LF (0A Hex or ^J) code when pressed.

### Function Keys

The fourteen function keys, F1 thru F4, and seven other special keys transmit a unique control sequence. Frequently an additional piece of software is used along with a spreadsheet, wordprocessor, etc. to translate the control sequences into standard commands or pieces of frequently-used text. FUNCTION KEYS SELDOM DO USEFUL WORK ON THEIR OWN WITHOUT SUCH INTERMEDIATE SOFTWARE. So don't be surprised if your arrow keys don't move the cursor around the way you may expect. That requires extra software. Morrow's KEY.COM is an example of such software.

The reason you need extra software, incidentally, is that there's no standardization among terminals where cursor movement is concerned. A software author would have to be willing to produce hundreds of versions of his program if he wanted it to recognize every terminal's cursor (and other) function keys.

As noted above, each function key has three possible codes: when used alone, with SHIFT, and with CTRL. Also noted was that the numbers and other symbols in the numeric keypad can be made to send function key control sequences. See "Numeric Keypad".

The MT 70 function keys are illustrated in Figure 3-6; the control sequence transmitted by each key is listed in Table 3-2.

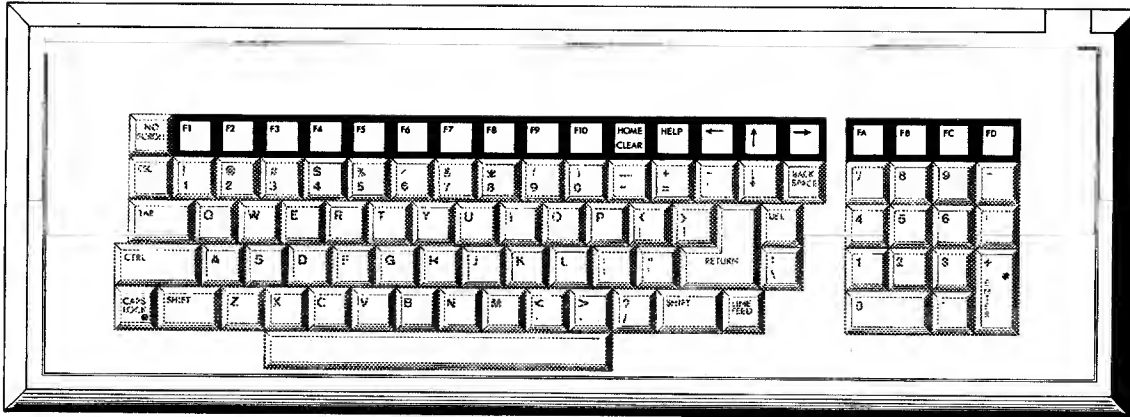


Figure 3-6: MT 70 Function Keys

Table 3-2: Function Key Codes

NOTE: Every function code sequence begins with 1C Hex when in Morrow mode (configuration switch paddle 8 ON.)

| KEY<br>CODE | UNSHIFTED CODE |          | SHIFTED CODE |       | CONTROL CODE |       |
|-------------|----------------|----------|--------------|-------|--------------|-------|
|             | Hex            | ASCII    | Hex          | ASCII | Hex          | ASCII |
| F1          | 40             | @        | 60           | `     | 0            | NUL   |
| F2          | 41             | A        | 61           | a     | 1            | SOH   |
| F3          | 42             | B        | 62           | b     | 2            | STX   |
| F4          | 43             | C        | 63           | c     | 3            | ETX   |
| F5          | 44             | D        | 64           | d     | 4            | EOT   |
| F6          | 45             | E        | 65           | e     | 5            | ENQ   |
| F7          | 46             | F        | 66           | f     | 6            | ACK   |
| F8          | 47             | G        | 67           | g     | 7            | BELL  |
| F9          | 48             | H        | 68           | h     | 8            | BS    |
| TAB         | 9              | HT       | 1A           | SUB   | 1B           | ESC   |
| ↑           | 4A             | J        | 6A           | j     | A            | LF    |
| ↓           | 4B             | K        | 6B           | k     | B            | VT    |
| ←           | 4C             | L        | 6C           | l     | C            | FF    |
| →           | 4D             | M        | 6D           | m     | D            | CR    |
| HOME/CLEAR  | 4E             | N        | 6E           | n     | E            | SO    |
| HELP        | 4F             | O        | 6F           | o     | F            | SI    |
| F10         | 50             | P        | 52           | R     | 53           | Q     |
| FA          | 1C             | FS       | 7C           |       | 5C           | \     |
| FB          | 1D             | GS       | 7D           | }     | 5D           | ]     |
| FC          | 1E             | HOME     | 7E           | ~     | 5E           | ^     |
| FD          | 1F             | NEW LINE | 7F           | DEL   | 5F           | _     |

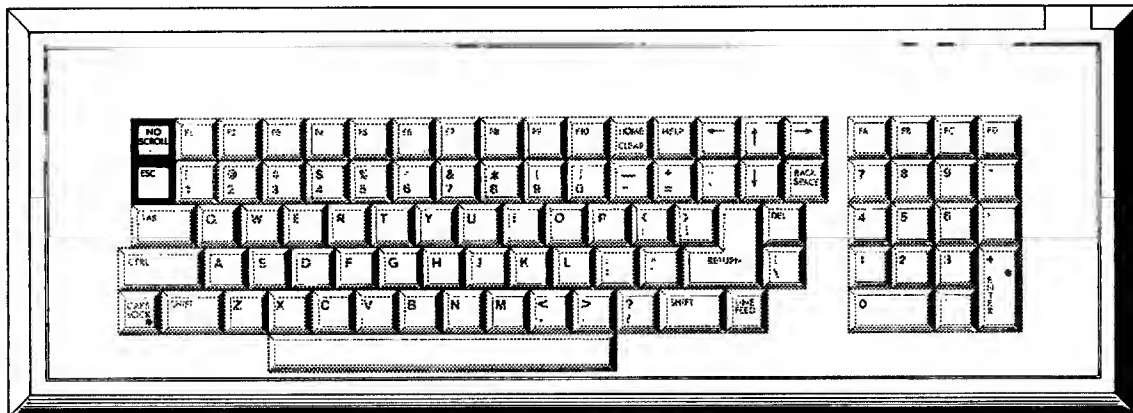
Notice that the arrow keys, HELP, and HOME/CLEAR are like the plus sign on the numeric ENTER key. There is no intrinsic meaning in the way these keys have been labelled. This is for your convenience if you decide to employ them for such purposes by using additional function key software.

**NOTE:** Be aware that all Morrow Micro Decisions (starting with CP/M 2.2 rev. 2.5 and CP/M 3.0 rev. 1.8) have a built-in key translator called KEY.COM. It is designed specifically for use with the Morrow MDT 60 and MT 70 terminals. Thus many of your function keys will have predefined meanings that are triggered by the codes listed above. Refer to the MD-11 User's Guide or the Micro Decision "Read Me First" manual for details on KEY.COM.

Morrow will also have available as of May 1984 "Smart Key II", which is similar to KEY.COM but is more flexible. This is for MD-2's and MD-3's only.

### Special Operation Keys

The keys listed below perform special operations or have a unique effect on the MT 70.



**Figure 3-7: Special Operation Keys**

ESC generates a special control code (1B Hex), usually followed by one or more characters, used for command operations. Thus, ESCape is usually considered as a "lead-in" character for terminal control operation. "Control Codes and Escape Sequences" and Table 3-4 detail the escape sequences utilized by the **MT 70**.

NO SCROLL generates a ^S (13 Hex) when pressed. This freezes the rapid scrolling of information up the screen. NO SCROLL is commonly used when viewing output of pip, dir, and type commands.

The second time NO SCROLL is pressed, it sends ^Q (11 Hex), which resumes the scrolling.



## CONTROL CODES AND ESCAPE SEQUENCES

Control codes and escape sequences are special characters that tell the terminal to act a certain way instead of simply displaying a character. Examples include positioning the cursor and ringing the terminal's bell. These codes usually come from application programs, so this information is primarily of interest to programmers; however, some explanatory text is included for general interest.

### Control Codes

The operational characteristics of the MT 70 are controlled, in part, by a group of control codes which may originate at the computer or at the keyboard. Control codes are not displayed. Instead, they cause some other response like cursor movement or clearing the screen. Of the 32 ASCII standard control codes available for use, the MT 70 utilizes the 10 control codes listed in Table 3-3.

Control codes are like regular display character codes in that they require only one byte for transmission. They are distinct in that their 2 high bits (6 and 7) are clear (0). Thus the Hex values 00-1F make up the available Control codes.

Usually when you're running an application program, the Control codes will be read by the program and interpreted differently from the meanings in Table 3-3. For example, CTRL-K (^k) tells NewWord to go to its Blocking and Saving menu, not to move the cursor up as the table indicates. However, NewWord may send a CTRL-K to the terminal when it wants the cursor to move up, like when you enter a CTRL-E (^e) command. The confusion arises because there can be several layers of software capturing Control codes and translating them into something else.

To see the actual effects of the Control codes, type them at the A> or B> prompt, rather than while you're running a program. To see their ASCII symbols onscreen (like "NL" for Null), go into Monitor Mode first by typing ESC U.

### Escape Sequences

An Escape sequence is very similar to a Control code, in that it makes the terminal behave a certain way instead of simply displaying a character. The difference is that Control codes are fairly universal, standard codes among data communication gear, while Escape sequences are much more specialized to a particular piece of hardware.

Escape sequences were made necessary because of the versatility of modern terminals. There simply were not enough 1-byte combinations to represent all the characters, basic Control codes, and commands to govern the new terminals' capabilities. Thus Escape sequences require

two bytes, the first of which is always the ASCII "ESC" control code (1B Hex). This is followed by one or more otherwise displayable ASCII characters. The terminal checks incoming data to find ESC codes. When one arrives, it knows that the next character(s) will stand for a command instead of normal text.

Each Escape sequence controls a specific terminal operation. Some operations are one-time only, others stay in effect for as long as power to the unit is not interrupted or until the effect is terminated by another Control code or Escape sequence.

See Table 3-4 for a list of the MT 70's Escape sequences.

Table 3-3: Control Codes Recognized by the MT 70


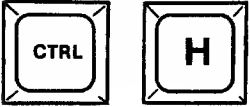
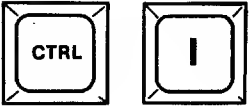

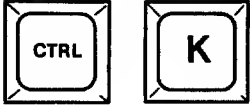










| CODE  |  | OPERATION                  | DESCRIPTION   |
|---|--|----------------------------|---|
|    |  | Bell                       | Sounds the terminal bell or beeper.   |
|    |  | Cursor Left<br>(Backspace) | Moves the cursor to the left one character position. The cursor moves to the last position of the previous line when at the first character position of the line. |
|  |  | Tab                        | Moves the cursor to the next tab stop, every eighth character position (modulo 8 column tabs).  |
|  |  | Cursor Down<br>(Line Feed) | Moves the cursor to the next line down in the same column. If the cursor is located on the bottom line, a scroll operation will be performed.                     |
|  |  | Cursor Up                  | Moves the cursor to the previous line in the same column. If the cursor is located on the top line, nothing happens.  |



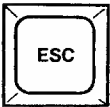

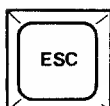

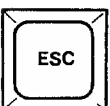
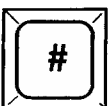
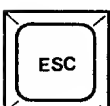

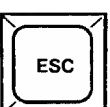


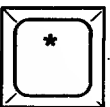
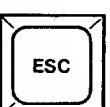
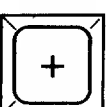
Table 3-3 (Continued)  
Control Codes Recognized by the MT 70

|   |   |                             |   |
|---|---|-----------------------------|---|
|    |    | Cursor Right                | Moves the cursor to the right one character position. The cursor moves to the first position of the next line, when at the extreme right end of a line. |
|    |    | Carriage Return             | Moves the cursor to the first character position of the current line.   |
|    |    | Clear Screen & Home Cursor  | Fills the display with spaces, and moves the cursor to the Home position (upper left corner).   |
|   |   | Home Cursor                 | Moves the cursor to the Home position (upper left corner) without clearing the screen.  |
|  |  | Carriage Return & Line Feed | Moves the cursor to the left edge of the next line down. Same as CTRL J and CTRL M together.  |







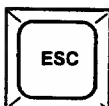
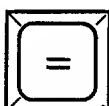

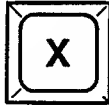

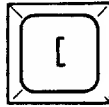

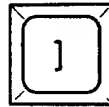
**NOTE:**

The CTRL key must be held down while pressing the associated key in the control code sequence, as when using a SHIFT key.

Table 3-4: MT 70 Escape Sequences

| ESCAPE<br>SEQUENCE  |           | COMMAND                                    | DESCRIPTION  |
|---|-----------|--|--|
|       | <b>n</b>  | Print Alternate<br>(Graphics)<br>Character | Causes the following<br>character "n" to be<br>printed from the alt-<br>ernate character set.                            |
|       | <b>0</b>  | Enable Screen Saver                        | Display goes blank if<br>the keyboard is not<br>accessed or data isn't<br>received from the com-<br>puter after 15 mins. |
|       | <b>1</b>  | Disable Screen<br>Saver                    | Display is constant<br>while power is on.  |
|     |           | Display Version                            | Displays the current<br>version number of the<br>monitor firmware (ROM).   |
|   |           | Set Graphics Mode                          | The characters @, A,<br>...~ and DEL (40 - 7F<br>Hex) are replaced with<br>Non-English and graph-<br>ics characters.     |
|   |           | Clear Graphics<br>Mode                     | Turns the Graphics<br>Mode off.  |
|   | <b>or</b> | Clear Screen                               | Causes all display data<br>data to be cleared and<br>replaced with spaces.   |
|   |           |  |  |

**Table 3-4 (Continued)**  
**MT 70 Escape Sequences**

| ESCAPE<br>SEQUENCE  | COMMAND                              | DESCRIPTION   |
|---|--------------------------------------|---|
|         | Set Dim                              | Causes all subsequent data to be displayed in half-intensity.   |
|         | Set Bright                           | Causes DIM to be terminated (return to full intensity).   |
|         | Alignment Check                      | Fills the screen with the character "H" for checking alignment.   |
|         | Address Cursor                       | Used to position the cursor to a specified row (R) and column (C) on the display. The location is expressed as two ASCII characters with an assumed offset of 20 Hex. The first specifies the row (space - 7 or 20-37 H). The second specifies the column (space - 0 or 20-6F H). |
|  ,  |                                      |   |
|     | Set Numeric Keypad Function Key Mode | Changes the numeric keypad to a function keypad (see Table 3-1).  |
|     | Clear Keypad Function Key Mode       | Restores function of numeric keypad to normal operation (numbers, minus, comma, ENTER, & period).   |

**Table 3-4 (Continued)**  
**MT 70 Escape Sequences**

**ESCAPE  
SEQUENCE**

**COMMAND**

**DESCRIPTION**



Set Cursor Type

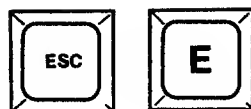
Specifies type of cursor displayed, as "n" equals:

- 0 - block, slow blink
- 1 - block, fast blink
- 2 - block, no blink
- 3 - underline, slow blink
- 4 - underline, fast blink
- 5 - underline, no blink
- 6 - no cursor
- 7 - leave cursor as it is



Read Cursor




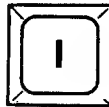

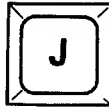
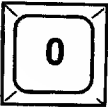

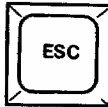
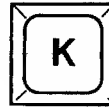
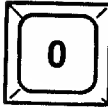



Causes the terminal to transmit the cursor row and column position in the same format as described in "Address Cursor" Command. Row position is transmitted first, followed by the column position.









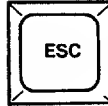

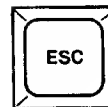

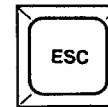
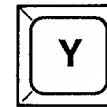
Insert Line

Causes a line of spaces to be inserted at the line containing the cursor. All lower lines scroll down one line, the bottom line being lost.

**Table 3-4 (Continued)**  
**MT 70 Escape Sequences**

| ESCAPE<br>SEQUENCE   | COMMAND          | DESCRIPTION   |
|--|------------------|---|
|   n  | Set Attribute    | <p>Sets general display characteristics, where "n" is:</p> <ul style="list-style-type: none"> <li>0 Normal</li> <li>1 Underline (UL)</li> <li>2 Dim</li> <li>3 UL and Dim</li> <li>4 Reverse (RV)</li> <li>5 RV and UL</li> <li>6 RV and Dim</li> <li>7 RV, Dim and UL</li> </ul> |
|    | Back Tab         | Cursor is positioned to the preceding tab stop.   |
|  <br>  | Keyclick On/Off  | <p>0 = keyclick off.<br/>           1 = keyclick on.</p>  |
|  <br>  | Inverse Screen   | <p>0 = Amber characters on black screen.<br/>           1 = Black characters on amber screen.</p>   |
|    | Insert Character | Moves all data from the cursor position to the end of the line one position to the right. A space is written at the cursor position.  |

**Table 3-4 (Continued)**  
**MT 70 Escape Sequences**

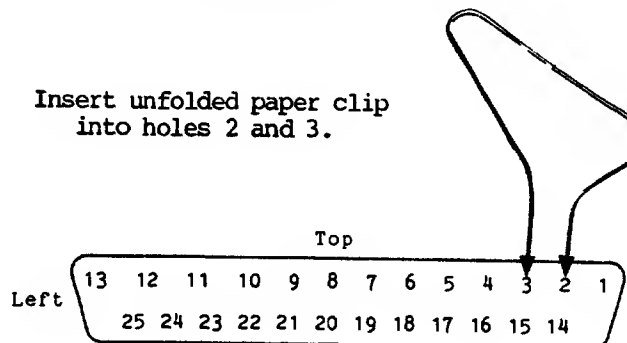
| ESCAPE<br>SEQUENCE  | COMMAND                | DESCRIPTION   |
|---|------------------------|---|
|       | Delete Line            | Erases the line containing the cursor and moves all lower lines upward one line.                        |
|       | Erase to End-of-Line   | Erases all data from the cursor position up to the end of the line.                                     |
|       | Set Monitor Mode       | Terminal displays the 32 control codes, but does not act on them.                                       |
|     | Delete Character       | Deletes the character under the cursor and moves all characters from the cursor to the end of the line. |
|   | Clear Monitor Mode     | Return to Normal Mode. The control codes recognized by the MT 70 are acted upon.                        |
|   | Erase to End-of-Screen | Erases all data from the cursor position to the lower right corner (replaced with spaces).              |



## DATA TRANSMISSION

Data entered from the keyboard is immediately transmitted to your computer character-by-character. This includes those control codes or escape sequences which are normally not displayed. For characters to display or for control codes / escape sequences to be acted upon, they must be sent back ("echoed") from the computer to the **MT 70**.

Computer echoing can be simulated in the absence of a computer by jumpering pins 2 and 3 of the **MT 70**'s DTE connector:



Transmission is serial asynchronous, with an ASCII character format of 1 start bit, 8 data bits, odd/even, or no parity bit and 2 stop bits. The word structure and baud rate used are selectable via the rear panel DIP switch.

Data communications takes place whenever the **MT 70** is connected to your computer. When receiving data, the **MT 70** uses an X-ON/X-OFF (^S/^Q) busy feature to command the computer to suspend transmission while the terminal is busy.

## CURSOR CONTROL

### Relative Cursor Positioning

The cursor may be moved to any position on the screen using the cursor control codes in Table 3-3. The cursor's current position thus implies where it will go next: one space left, right, up, or down. This means of moving the cursor is relatively primitive when more than one space's movement is required. See "Absolute Cursor Positioning" below.

### Absolute Cursor Positioning

Absolute cursor positioning (or "addressing") requires commanding the cursor to a specific display location. Commanding the cursor to a specific location ("loading the cursor") is normally executed by an application program in the computer. The Load command is executed by means of an escape sequence in which the row and column location of the cursor is expressed as a pair of ASCII characters.

Loading the Cursor**ESC=RC**

A program places the cursor in an exact position by sending the escape sequence "ESC=RC". The Row and Column numbers are represented by ASCII characters, NOT Hex or decimal numbers. There is an assumed offset of 20 Hex between the actual row or column number, and the ASCII character that represents it. For example, the coordinates of the upper left corner are 0,0. Add 20H to 0 and you find in Figure 1-4 that the ASCII character to type is "space" (space bar).

Thus the command to put the cursor in the upper left corner is:

**ESC=<space><space>**

Of course, you don't really type "<space>"; that means press the space bar.

There are 24 rows; the top is represented by a space (20H), the next one down (21H) is represented by "!", and so on down to the bottom line (37H), which is represented by "7". Refer to Figure 1-4 if the logic of this eludes you.

There are 80 columns; the leftmost is represented by a space (20H), the next one to the right is represented by "!", and so on to the rightmost (6F), which is represented by "o".

EXAMPLE: ESC=1/ moves the cursor to Row 17, Column 15.

Scrolling

In the MT 70 data is entered into display memory starting at the HOME position (upper left corner), and continues through Position 80 of Line 24, (lower left corner). When Position 80 is filled, or when a New Line or Line Feed occurs in Line 24, the display is shifted upwards one line and data entry continues in Position 1 of the new Line 24. The original top line of the display is lost. Scrolling continues indefinitely.

The MT 70 contains no scrolling buffer.

**VISUAL ATTRIBUTES**

The MT 70 has various attributes used to highlight data on the display.

There are three Visual Attributes that can be assigned to any character or string of characters on the display. They include: Underline, Reverse Video, and Half Intensity. Combinations of these attributes can also be used.

The attribute is assigned once, and then all subsequent data entered will appear with the selected attribute. To return to normal attributes, send a second "normal" command: ESC G0.

To set visual attributes, enter the command:

**ESC G n**

The value of "n" selects the desired attribute as follows:

- |   |                                       |
|---|---------------------------------------|
| 0 | Normal                                |
| 1 | Underline                             |
| 2 | Half Intensity                        |
| 3 | Underline and Half Intensity          |
| 4 | Reverse                               |
| 5 | Reverse and Underline                 |
| 6 | Reverse and Half Intensity            |
| 7 | Reverse, Half Intensity and Underline |

## NOTES

**SECTION 4: CARE OF THE MT 70**

Proper care of the **MT 70** consists of performing the routine cleaning and inspection procedures listed below.

**CLEANING**

At periodic intervals, clean the exterior housing and lightly dust the unit using a soft brush or damp lint-free cloth. Do not use petroleum base cleaners, such as lighter fluid, as this could be harmful to the painted surface. Remove smudges from the CRT exterior screen and the housing with conventional glass cleaners or alcohol. Be careful not to scratch the CRT screen.

**INSPECTION**

Periodically inspect the keyboard assembly and switches for freedom of movement. Determine that the intensity of characters displayed on the CRT screen has not diminished too much. Any required mechanical and electrical adjustment shall only be performed by authorized Morrow Service Centers.

## NOTES

**SECTION 5: TROUBLESHOOTING THE MT 70**

If you encounter problems with the MT 70, you should first try turning it off, leaving it off for 15 seconds, and turning it back on. You can usually do this even while running a program, although your display will be blank afterwards. Enter one of the commands appropriate to the suspended program to get the screen repainted.

When you turn the terminal back on, the terminal Self-Test will be executed. Self-Test will verify the integrity of the display memory, the program memory, and the associated internal control logic. Upon completion of Self-Test, the terminal will sound its bell and the cursor will appear in the upper left corner of the screen. This takes less than a second.

The Self-Test can produce two possible error messages:

- o "Keyboard Not Connected" This indicates either that the keyboard is actually disconnected, or the keyboard, keyboard cable, or logic circuit board is bad. Check both ends of the keyboard cable for good connections. Turn the terminal off and back on. If the problem persists, call your dealer.
- o "System Memory Error" The RAM or ROM on the logic board failed the Self-Test. Turn the terminal off and back on. If the problem persists, call your dealer.

If the Self-Test does not produce either of these messages, refer to Table 5-1 for possible solutions to problems arising from improper switch settings, static electricity, etc.

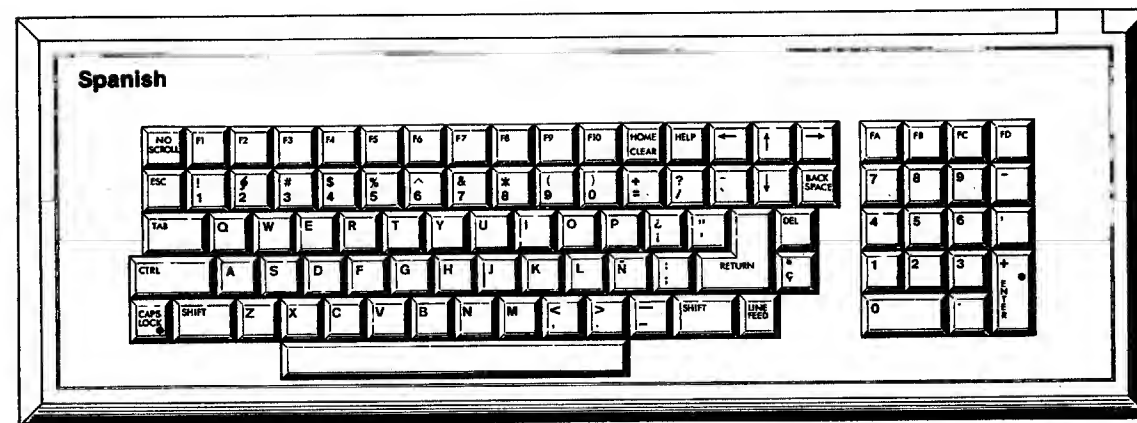
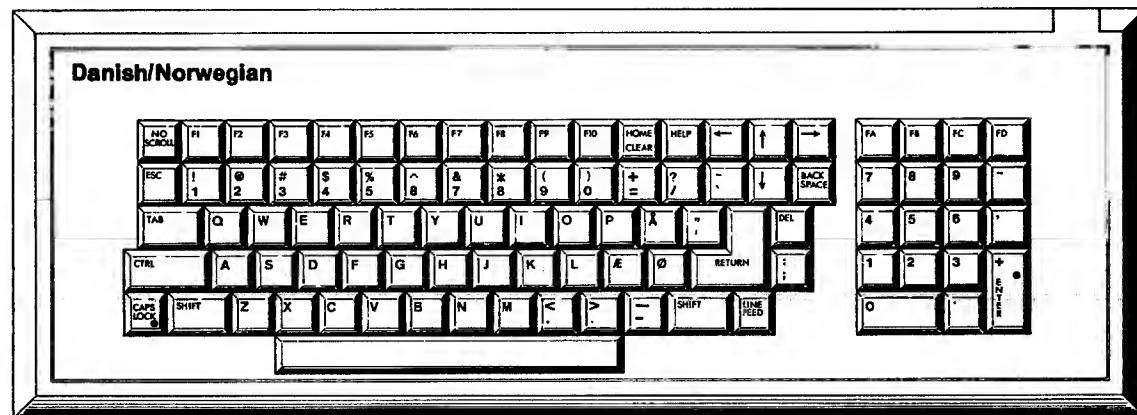
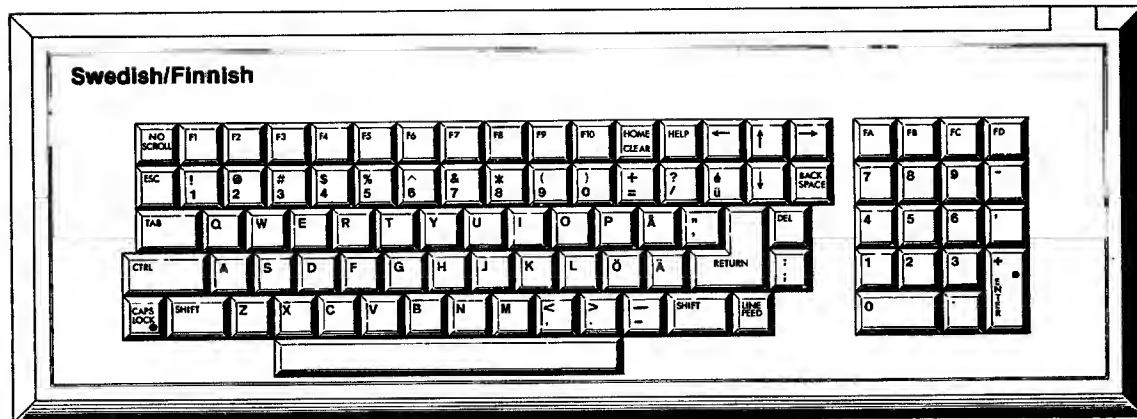
If you try everything in the chart without success, you probably have an internal problem with the terminal that should be referred to your Morrow dealer.

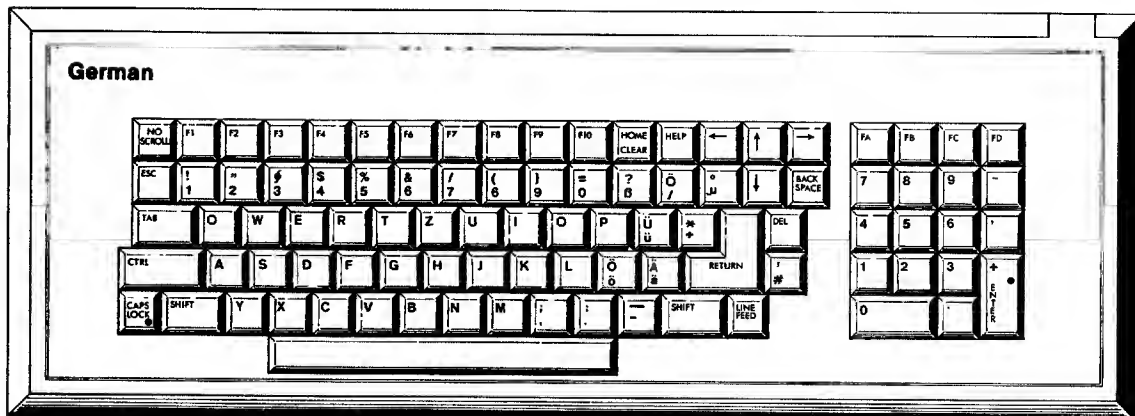
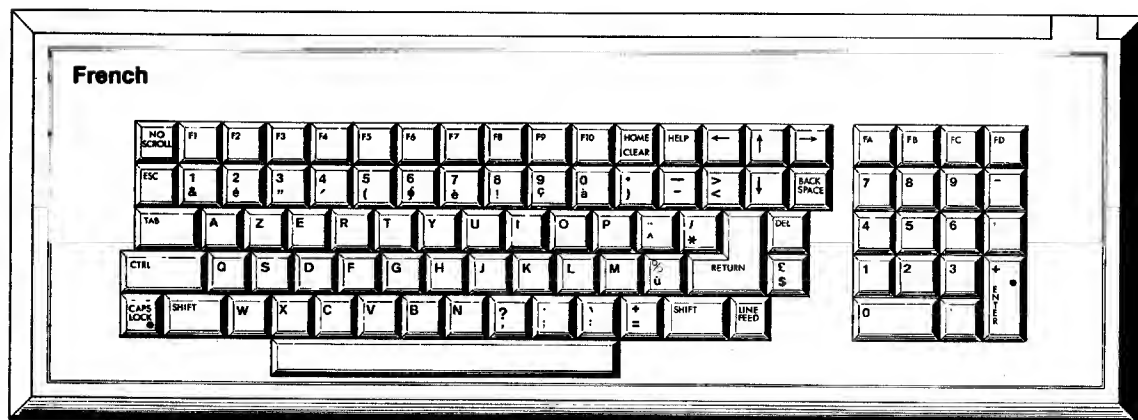
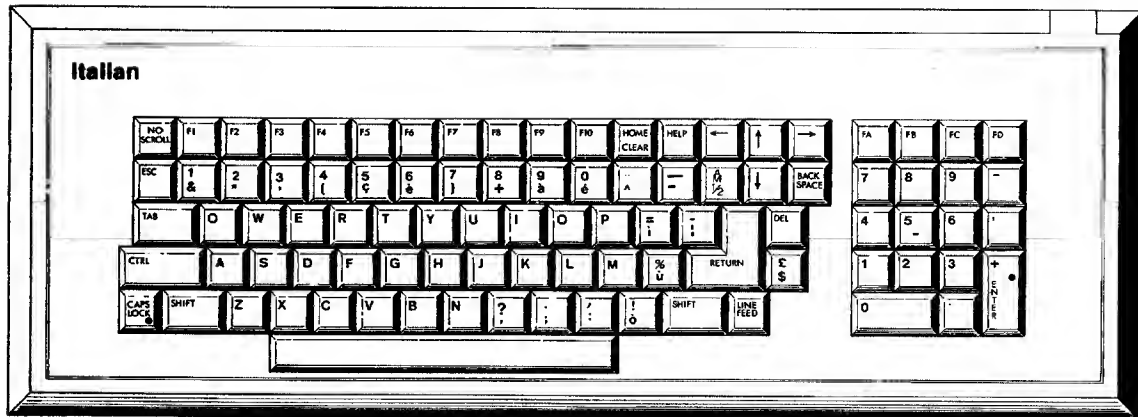
**Table 5-1: Troubleshooting Guide**

| <b>PROBLEM</b>                         | <b>PROBABLE CAUSE</b> | <b>SOLUTION</b>                               |
|--|-----------------------|---|
| "Dead" terminal<br>(no beep or cursor) | No AC power           | Plug power cord in.                           |
|  |                       | Turn power switch on.                         |
|  |                       | Check setting of line voltage switch.         |
|  |                       | Check .75 A slow-blow fuse in back panel.     |
|  |                       | Check power source with lamp or other device. |

|  |   |  |
|--|---|--|
| Error message appears at power-on                | Terminal failed Self-Test                                       | See text before this chart.  |
| No cursor but terminal does beep at power-on     | Light contrast setting, or cursor display disabled by software. | Adjust contrast control.<br><br>Type ESC, ", 0, and RETURN.  |
| Cursor appears but keys don't display when typed | Configuration switch settings are incorrect                     | Refer to Section 3.  |
|  | Keyboard is not properly connected                              | Check both ends of keyboard cable for snug connection.   |
|  | Computer is not booted  | Boot computer according to its instructions.   |
|  | Terminal cable is not properly connected                        | Check that the cable is firmly attached to DTE connector at terminal end, and TERMINAL connector at computer end.  |
| Terminal displays "garbage" characters           | Configuration switch settings are incorrect                     | Refer to Section 3.  |
|  | Computer's baud rate has been changed                           | With Micro Decisions, run SETUP.COM to verify that the computer's baud rate matches the terminal's, as determined by its configuration switches. Other computers will have similar programs or switches. |
|  | Static electricity  | Spray carpeting with antistatic spray, or install antistatic floor mat.  |
|  | Cable and power cords are wrapped together                      | Separate cables to eliminate interference.   |



**APPENDIX A    EUROPEAN CHARACTER SETS (KEYBOARD LAYOUTS)**



APPENDIX B    PROGRAMMING IN BASIC AND PILOT FOR THE MT 70

This section provides typical BASIC and PILOT commands for exercising the escape sequences and control codes recognized by the MT 70. The upper line is BASIC, signified by [B]; the lower line is its PILOT equivalent [P].

## 1. Clear screen and home cursor:

```
PRINT CHR$(26)      [B]
CLRS:               [P]
```

## 2. Absolute cursor positioning:

```
PRINT CHR$(27);"=";CHR$(ROW+32);CHR$(COL+32)      [B]
```

This assumes that ROW and COL are previously defined variables, representing the decimal number of the row (0-23) and column (0-79).

```
CUR:C,R          [P]
```

PILOT expects column and row number in the opposite order from BASIC. They are expressed as decimals from 0-23 for row and 0-79 for column.

## 3. Set visual attribute:

```
PRINT CHR$(27);"G";"n"      [B]
T:^^1B^^47n                 [P]
```

where n is a digit 0 - 7:

- 0 = Normal (full intensity, no reverse or underline)
- 1 = Underline
- 2 = Half intensity
- 3 = Underline + half intensity
- 4 = Reverse
- 5 = Reverse + underline
- 6 = Reverse + half intensity
- 7 = Reverse, half intensity, + underline

There are alternative commands for half and full intensity that exist as an anomaly; they're exactly equivalent to the commands above:

```
PRINT CHR$(27);")"      [B]  for half intensity
T:^^1B^^29              [P]
```

```
PRINT CHR$(27);"("      [B]  for full intensity (normal)
T:^^1B^^28              [P]
```

## 4. Set cursor type:

```
PRINT CHR$(27);CHR$(34);"n"    [B]
T:^^1B^^22n                    [P]
```

where n is a digit 0 - 6:

- 0 = Block, slow blink
- 1 = Block, fast blink
- 2 = Block, no blink
- 3 = Underline, slow blink
- 4 = Underline, fast blink
- 5 = Underline, no blink
- 6 = no cursor

## 5. Home cursor without clearing screen:

```
PRINT CHR$(30)                [B]
CUR:0,0                        [P]
```

## 6. Ring terminal's bell:

```
PRINT CHR$(8)                 [B]
BELL:                          [P]
```

## 7. Enter Graphics Mode:

```
PRINT CHR$(27);"$"           [B]
T:^^1B^^24                    [P]
```

To leave Graphics Mode:

```
PRINT CHR$(27);"%"           [B]
T:^^1B^^25                    [P]
```

## 8. To display all of the graphics and European characters available in your character ROM:

```
10 PRINT CHR$(27);"$"        [B]
20 FOR X=0 TO 127
30 PRINT CHR$(X);
40 NEXT X
50 PRINT CHR$(27);"%"
```

```
C: A=0                        [P]
C: B=128
T:^^1B^^24
*LOOP
TNR:^^#A
C: A=A+1
C: C=B-A
JY: *LOOP
T:^^1B^^25
END:
```

## 9. Enter Numeric Keypad Function Key Mode:

```
PRINT CHR$(27); "["      [B]
T:^^1B^^5B               [P]
```

To return the keypad to normal numeric mode:

```
PRINT CHR$(27); "]"      [B]
T:^^1B^^5D               [P]
```

In case you haven't made the connection yet, "CHR\$(27)" stands for the ESC code in an escape sequence. It means "send the terminal the code for the 27th ASCII character." The 27th character in Hex is the 1Bth character, which you can see from Figure 1-4 and Table 1-1 is ESC.

"T:^^ ..." is an otherwise undocumented feature of PILOT which means "send the terminal this hex character, without treating it as if it were text." 1B, as noted above, is the Hex code for ESC.

In the numeric keypad item above, a pattern really emerges when you note that 5B is the Hex code for [, and 5D is the Hex code for ].

## NOTES

APPENDIX C    MT 70    SPECIFICATIONS

| SPECIFICATION           | DESCRIPTION  |
|-------------------------|--|
| <b>DISPLAY</b>          |  |
| CRT Screen              | 12-inch (30.5 cm) diagonal, amber LA Phosphor with frosted face-plate.   |
| Vertical Refresh Rate   | 60 Hz, non-interlaced.   |
| Horizontal Refresh Rate | 18.07 KHz  |
| Display Page            | 1920 characters/page.  |
| Display Format          | 80 characters x 24 lines.  |
| Character Set           | 128 ASCII characters.<br><br>45 special characters for foreign character sets (U.S., U.K., German, Spanish, French, Italian, Swedish/Finnish, Danish/Norwegian).   |
|                         | 64 special graphics characters, 16 of which are line drawing graphics characters.  |
| Character Matrix        | 8 x 10 dot matrix.   |
| Character Field         | 9 x 12 dot matrix.   |
| Cursor                  | 9 x 12 dot matrix, selectable block or underline; steady, slow blink, fast blink, or no cursor.  |
| Cursor Controls         | Left, Right, Up, Down, Home, Carriage Return/Line Feed, Tab, Read Cursor and Cursor Addressing.  |
| Visual Attributes       | Reverse video, underline, reduced intensity (dim), and combinations thereof (non-embedded).  |
| Alphanumeric            | 26-letter alphabet with upper and lower case, numerics 0 through 9, Return, Shift, Punctuation, Backspace, Tab, and Caps Lock. Most keys are auto repeating (approximately 15 characters per second). Selectable audible keyclick. |

**Table C-1 (Continued)**  
**MT 70 Specifications****SPECIFICATION****DESCRIPTION**

Screen Saver

After 15 minutes of no input, screen automatically blanks without loss of data; any keystroke restores the display.

**KEYBOARD**

Alpha Keypad

75 keys: standard typewriter keys plus cursor keys, F1-F10 function keys, "No scroll" (^S/^Q), HOME/CLEAR, ESC and CTRL.

Numeric Key Pad

18 keys: 0 - 9, Enter, Comma, Period, Minus, FA, FB, FC and FD.

Auto Repeat

After pause, the depressed key repeats in accelerating manner, up to 15 times per second.

**EDITING**

Remote Edit Operation

Clear screen, insert character, delete character, insert line, delete line, erase to end of line, erase to end of screen.

**COMMUNICATIONS**

Monitor Mode

Control characters from the computer are displayed on the screen without being acted upon.

Data Rates

300, 1200, 9600 and 19200 baud.

Word Length

8 Data bits.

Parity

Even, odd, or no parity.

Stop Bits

2 stop bits.

Format

RS-232 serial asynchronous.



**Table C-1 (Continued)**  
**MT 70 Specifications**

| <b>SPECIFICATION</b>   | <b>DESCRIPTION</b>   |
|------------------------|--|
| <b>GENERAL</b>         |  |
| Operating Environment: |  |
| Temperature            | Operating: 10 to 40 degrees C (41 to 104 degrees F).<br><br>Storage: -15 to 65 degrees C (5 to 150 degrees F). |
| Humidity               | 10% to 85% without condensation.   |
| Power Requirements:    |  |
| Standard               | 115V +/- 10%, 60 Hz, 50 watts.   |
| Optional               | 230V +/- 10%, 50 Hz, 50 watts.   |
| Dimensions:            |  |
| Width (Monitor)        | 12.75 inches (32.0 cm)   |
| Depth (Monitor)        | 12.0 inches (30.5 cm)  |
| Height (Monitor)       | 13.7 inches (34.8 cm)  |
| Depth (Keyboard)       | 7.15 inches (18.0 cm)  |
| Height (Keyboard)      | 1.0 inches (3.8 cm)  |
| Weight (total)         | 24.2 pounds (11.0 kg)  |

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MORROW

